

## Clinical Profile and Outcome of Myocarditis in Children at Dr. Hasan Sadikin General Hospital Bandung from 2008 to 2012

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### Abstract

**Background:** Diagnosis of myocarditis in children is still challenging due to its inconsistent and wide spectrum of clinical manifestations. There is no specific laboratory test available. This may obscure the true incidence of myocarditis. The purpose of this study was to describe clinical profile and outcome of myocarditis in children.

**Methods:** A descriptive study was performed using 80 medical records of hospitalized pediatrics patients with myocarditis in Dr. Hasan Sadikin General Hospital Bandung from January 2008 to December 2012. The obtained data were age, gender, nutritional status, etiology, chief complaint, physical examination, laboratory findings, other examinations and outcome of the disease. The collected data were analyzed and presented in the form of frequency distribution.

**Results:** The mean age of the patients was 91.46 (45.93) months old, predominantly male. The most etiology was dengue infections (61%). High fever was found as the most common chief complaint (38%) and the most common found in physical examinations were tachypnea (65%) and hepatomegaly (55%). Electrocardiography (ECG) showed the first degree atrioventricular block (AV block) (35%), aspartate aminotransferase (AST) and creatine kinase myocardial band (CKMB) was increased in more than 80% of patients. The majority of patient was improved. Shock was the common complication.

**Conclusions:** Dengue is the most etiology of myocarditis etiology. Tachypnea, hepatomegaly, the first degree AV block in ECG, elevated AST and CKMB were the most common presentations. Most of the patients were improved during treatment. [AMJ.2017;4(1):118-24]

**Keywords:** Children, dengue, hepatomegaly, myocarditis, tachypnea

### Introduction

Myocarditis is an insidious disease with a variety of signs and symptoms which cause difficulty in diagnosis.<sup>1,2</sup> This disease has many etiologies, pathophysiology, diagnostic ways, and therapies.<sup>3</sup> The incidence of myocarditis remains obscure due to difficulties in diagnosing this disease because of its inconsistency of clinical manifestation in pediatric population and assuredly underdiagnosed.<sup>1,3</sup> Children may present with nausea and vomit that may be mistakenly diagnosed of having gastroenteritis or present with tachypnea, which may lead to asthma.<sup>4</sup> In addition to the clinical presentations, the diagnosis can also be made based on

noninvasive imaging findings, namely chest radiography, Electrocardiography (ECG), and echocardiography.<sup>1,4,5,6</sup> Laboratory test usage in diagnosing myocarditis is limited, but Freedman et al.<sup>2</sup> demonstrated that aspartate aminotransferase (AST) is a sensitive test, its rise in 85% case of myocarditis.<sup>1,2</sup> Cardiac enzymes, Troponin T, creatine kinase (CK) and creatine kinase myocardial band (CK-MB), may provide additional information in the evaluation of children with suspected viral myocarditis.<sup>3,7</sup>

Diagnosing myocarditis in children is a clinical challenge because the clinical scenario and findings from diagnostic tools vary greatly.<sup>8</sup> However, this disease may proceed to dilated cardiomyopathy which will need long-

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term therapy, even a heart transplant, and may be an important cause of sudden death in the pediatric population.<sup>1</sup> The aim of this study was to describe clinical profile and outcome of myocarditis in children.

## Methods

The design of this study was descriptive from secondary data. Data were obtained from total population of inpatients medical record of children with myocarditis in Dr. Hasan Sadikin General Hospital Bandung, Indonesia between January 2008 and December 2012. All pediatric patients  $\leq 14$  years old were included. The data was excluded if the recording was incomplete, including lost of pages, uncontained ECG, echocardiography, chest x-ray, and laboratory examinations (AST, CK, and CKMB). This study has been approved by The Health Research Ethics Committee.

The obtaining data was included: the age of the patients, gender, nutritional status, etiology of myocarditis based on the diagnoses at admission, chief complaint, physical examination including general appearance, vital signs (blood pressure, pulse rate, respiratory rate, temperature), body weight, height, capillary refill time, heart sounds, hepatomegaly, splenomegaly and edema, laboratorial examinations including cardiac

enzymes (AST, CK, CKMB), other examinations including ECG, echocardiography, chest x-ray, and also outcome. Echocardiography, ECG, chest x-ray, AST, CK, and CKMB examinations were expertised by consultant physicians.

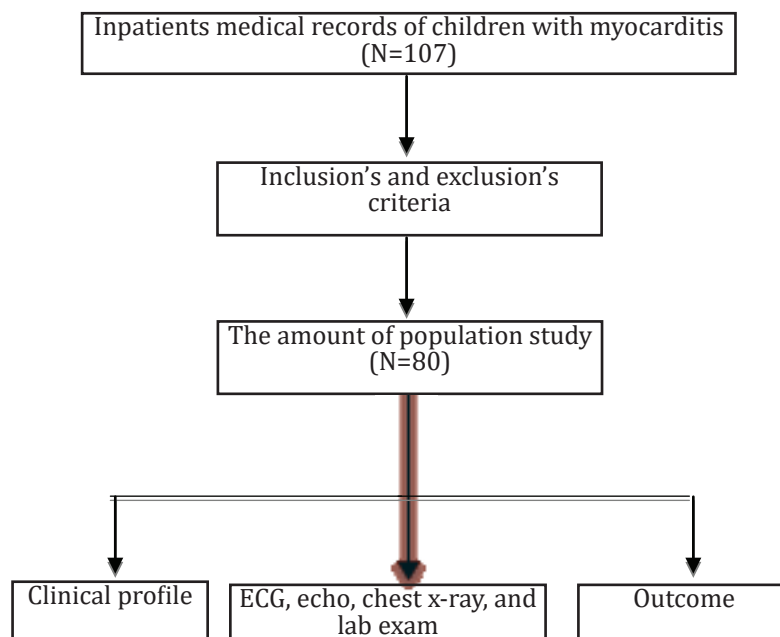
The collected data were analyzed and presented in the form of frequency distribution.

## Results

There were 107 cases were diagnosed as myocarditis from 31,546 hospitalized at Dr. Hasan Sadikin General Hospital Bandung from January 2008 to December 2012. Therefore, the frequency of children presenting with myocarditis was 0.34%. Twenty seven cases were excluded because the medical records were not available or the data were incomplete; due to lack of laboratory examination or ECG, echocardiography, or chest radiography.

The mean of age was  $91.46 \pm 45.93$  months old (Table 1) and 51 of them (64%) were male. Many patients (61%) had dengue infection as their etiology (Table 2), with 1 of them (2%) was dengue encephalopathy, 7 of them (14%) were dengue fever, 17 of the patients (35%) were dengue hemorrhagic fever, and 24 of them (49%) were dengue shock syndrome.

Sixty-eight patients (85%) were fully alert and 56 patients had normal nutritional status (Table 3). There were 63 data of blood



**Figure 1 Flow of The Study**

**Table 1 Clinical Profile Myocarditis in Children**

Clinical Profile	Mean (SD)/median (min-max)
Age (months)	91.46 (45.93)
Blood Pressure	
Sistole (mmHg)	10(13.41)
Diastole (mmHg)	66 (palpated – 100)
Pulse Rate	76 (40–160)
Respiratory Rate	26 (18–60)
Temperature (°C)	37 (35–39)
Body Weight (kg)	21 (3–52)
Body Height (cm)	119 (49–153)
Head Circumference (cm)	38.5 (35–44)

Note: Data presented are mean value (SD) or median (range)

pressure that were available. The others 17 data were incomplete for body height or blood pressure, which made it difficult to categorize the blood pressure. Forty-four patients (70%) had normal blood pressure for age, 51 patients (64%) had normal pulse rate, but 16 of them (31%) had irregular pulse rate, and 62 patients (79%) had normal temperature. Fifty-two patients (65%) had tachypnea with median 26 per minute (Table 2). Seventy-six patients (95%) had  $\leq 2$  second for capillary refill, 44 patients (55%) had hepatomegaly, 5 patients (6%) positive for splenomegaly and 15 (19%) were positive for edema. There were 79 data available for temperature, heart sounds, splenomegaly, and edema, due to lack of data.

Seventy patients (89%) had normal first (S1) and second (S2) regular heart sounds, 5 patients (6%) had normal S1 and S2 followed by gallop and/or murmur, and 4 patients (5%) had abnormal S1 and S2 followed by gallop and/or murmur.

Thirty patients (38%) came to the hospital with high fever, 21 patients (26%) came with cold body or extremities, and the other patients have edema face/body, heart throbbing, seizure, erythematous whole body, fatigue, chest pain, low fever, lost of consciousness, breathlessness, and regular check up for heart problem as their chief complaint. From the history, 59 patients (74%) had nausea, vomit, epigastric pain, abdominal pain, fatigue, bleeding, cough, flu, headache, or diarrhea,

**Table 2 Etiologies of Patients Myocarditis**

Etiology	N	%
Dengue Infections*	49	61
Pneumonia*	5	6
Sepsis*	5	6
Typhoid fever	3	4
Meningitis *	3	4
Nephrotic Syndrome	2	3
Rheumatic Fever	1	1
Steven Johnson Syndrome	1	1
Tuberculosis	1	1
Others	10	13
Total	80	100

Note: \* Some of the patients also followed by anemic, malnutrition, HIV infection, Thalassemia, Mitral regurgitations, Epilepsy, myocardial ischemia, intracranial high pressure, or empyema.

**Table 3 Distribution of Patient's Physical Examinations(1)**

Categories	n	%
Nutritional Status:	(n= 80)	100
Normal	56	70
Wasted	6	8
Severely wasted	4	5
Possible risk of overweight	1	1
Overweight	4	5
Obese	2	3
Undefined*	7	9
Level of consciousness	(n= 80)	100
Fully alert	68	85
Lethargic	4	5
Somnolent	4	5
Stupor	4	5
Blood Pressure	(n= 63)	100
Normal	44	70
Low	4	6
Prehypertension	4	6
Hypertension type I	7	11
Hypertension type II	4	6
Pulse rate	(n= 80)	100
Normal	51	64
Low	22	28
High	7	9
Respiratory rate	(n= 80)	100
Normal	27	34
Slow	1	1
Fast	52	65
Temperature	(n= 79)	100
Normal	62	79
Low	2	3
High	15	19
Capillary refill	(n= 80)	100
≤ 2 second	76	95
> 2 second	4	5
Heart Sounds	(n= 79)	100
Normal	70	89
Abnormal	9	11
Hepatomegaly	(n= 80)	100
Negative	36	45
Positive	44	55

**Table 3 Distribution of Patient's Physical Examinations (2)**

Categories	n	%
Spleen enlargement	(n= 79)	100
Negative	74	94
Positive	5	6
Edema	(n= 79)	100
Negative edema	64	81
Positive edema	15	19

Note: \* Data were not available for body height or weight

**Table 4 Distribution of Patient's Laboratory Examinations**

Categories	N	%
AST	(n=23)	100
Normal	4	17
Elevated	19	83
Median (range)	100 (25–1125)	
CK	(n= 38)	100
Normal	21	55
Low	7	18
High	10	13
Median (range)	98.5 (5–3613)	
CKMB	(n= 51)	100
Normal	10	20
High	41	80
Median (range)	35 (16–348)	

Note: Data presented are median (range) or number of patients. AST = Aspartate aminotransferase; CK = Creatine kinase; CKMB = Creatine kinase myocardial band

with 23 of them followed by fever and the rest of them had edema in palpebral/ face/ extremities/ body, preceded by sudden high fever, chest pain, breathlessness, and no other complains. History was taken during patients admitted to the hospital.

The data for ECG available in 60 patients, echocardiography in 17 patients, and chest x-ray in 39 patients. In 21 patients (35%), the ECG showed first degree atrioventricular block (AV block), 9 patients (15%) sinus bradycardia, and the others abnormalities were (43%), sinus tachycardia, QRS wave low voltage, left and/or right ventricular hypertrophy, prolonged QT wave interval, left and/or right atrial hypertrophy, prolonged QRS interval. Only 4 patients (7%) had normal ECG, one patient with total AV block who required temporary pace maker.

In 6 patients (35%) the echocardiography

showed normal intracardiac, 6 patients (35%) had mitral regurgitation, 2 patients (12%) had left ventricular dysfunction, and the others (18%) with pulmonary hypertension, dilated all chambers, and patent ductus arteriosus were report in 1 person each. Twenty-five patients (66%) had normal cardiac size with lung infiltrate pleural effusion in 12 patients on their chest x-ray examination.

The laboratory result showed elevated AST in 19 (83%) of 23 patients, normal CK in 21/38 patients (55%) and elevated CKMB in 41/51 patients (80%) (Table 4). Sixty-four (80%) patients had satisfactory result with improvement as their outcome, 2 (3%) patients were not improved, and one patient died due to severe sepsis. Thirteen (16%) patients had unknown outcome due to unavailable of information in the records. The median length of stay was 5 (range: 1-31) days.



## Discussion

This study examined 80 medical records of pediatric patients who were diagnosed with myocarditis at Dr. Hasan Sadikin General Hospital Bandung from January 2008 to December 2012. Pediatric myocarditis represented 0.34% of 31,546 hospitalized pediatric patients at that period. In other studies, autopsy reports have revealed varying estimations of the incidence of myocarditis, ranging from 0.12% to 12%.<sup>5,9</sup> This different finding might be caused by different kinds of approach of studied. The incidence of myocarditis has been difficult to be studied because the clinical presentations vary widely and myocarditis is commonly found as a mild or subclinical disease.<sup>5,9</sup>

Many of the children were not diagnosed with myocarditis at first presentation because the subclinical presentation and the underlying infection was the established diagnosis at admission.<sup>2</sup> Most of the patients had dengue infection, especially dengue shock syndrome, as the etiology. Another study in Sri Lanka has shown that myocarditis was present in 24% of patients with dengue infection in 2002–2003 and 27% of patients with dengue infection in 2009.<sup>10,11</sup> It might be caused directly by the effect of the dengue virus or due to cytokine mediators and/or cellular components of the immune response.<sup>10</sup> However, there were only 49 cases of dengue infections reported in this study. It is important to note due to dengue being epidemic in Indonesia<sup>12</sup> and Dr. Hasan Sadikin General Hospital received hundreds of dengue patients each year. The other etiologies predominantly were infectious disease. Ten patients had others etiology that was not defined. These patients came to the hospital with some chief complaints. They are chest pain, breathlessness, heart throbbing, or regular check up. This finding shows that myocarditis could be also considered as a complication of other diseases.

The most common chief complaint and symptoms at the time of admission were high fever and nausea, vomit, epigastric pain, fatigue, cough, flu, headache, diarrhea, abdominal pain, and bleeding. These symptoms are commonly caused by infection. It is important to highlight that these are results of anamnesis at time of admission and are not at the time when myocarditis is suspected.

The most common physical examination finding when the patients are suspected of having myocarditis were elevated respiratory rate and hepatomegaly. Respiratory distress,

tachypnea, and abnormality respiration examination are common in pediatric patients, it is the reason for consideration of asthma and pneumonia at initial diagnosis.<sup>4</sup> Hepatomegaly are also common, but not essential.<sup>15</sup>

Chest radiography and ECG can be used as the first line diagnostic tools.<sup>1</sup> In our cases, chest x-ray was available in 39 patients and the most common finding was normal heart size (25 patients). The chest radiographies were not sensitive enough to diagnose myocarditis.<sup>2</sup> Even though the most common ECG changes in myocarditis are sinus tachycardia, axis deviation, ventricular hypertrophy, ST-T waves changes, low voltage QRS complex, or inverted T wave.<sup>4</sup> From our 60 patients that had ECG, the most common finding was first degree AV block (35%). Sinus bradycardia was found in 15% of patients and sinus tachycardia in 10% of patients. Six of our patients in their echocardiography showed normal intracardia and mitral regurgitations found in five. The echocardiography allowed the evaluation of cardiac chamber sizes, walls thickness, and cardiac function<sup>6,14</sup>, but in our cases the finding were mostly normal.

In patients with myocarditis, CKMB is elevated in the acute stage of the disease but return to normal after recovery.<sup>15</sup> In this study, 38 patients were tested for CK and most of them (21 patients) were within normal range, but for CKMB, from 51 patients that were tested, 41 of them (80%) had increased level of CKMB. The AST level was the most sensitive marker for myocarditis, as it was frequently found to be elevated.<sup>4</sup> In 23 patients that were tested for AST, 19 patients (83%) had elevated level. It was found that laboratory test for cardiac enzymes, especially CK-MB and AST, had a tendency to rise in myocarditis.

In other studies reported that death or heart transplantation were high in patients at 6 years old.<sup>16</sup> In contrary, many with myocarditis children in other studies were found recovered without emergencies.<sup>13</sup> This study was a retrospective approach, it is our limitation to have the patients followed up information. However, in our cases, the most common complication in patients was shock due to the most etiology was dengue infections, especially dengue shock syndrome. The patients' outcome showed most of them had improvement (80%) with 29 of them full recovery and 35 of them need to be followed up, and mortality found in only one case. The cause of mortality was sepsis shock and empyema. Two patients refused to get further treatment and went home with no improvement. This

finding showed that myocarditis was not life threatening.

The limitation of this study was retrospective study that used medical record. The data that we received based on what were in the medical record were incomplete data, non-standardized data obtained, no further information about follow up patients. They were our limitation.

From this study, it can be concluded that myocarditis appeared with low frequency (0.34%) in pediatric patients at Dr. Hasan Sadikin General Hospital Bandung from January 2008 to December 2012. This might be caused by underdiagnosed or misdiagnosed. Dengue infections appeared to be the most etiology of myocarditis. From the clinical profile, elevated respiratory rate and hepatomegaly are the most common presentations in our myocarditis patients. The finding showed most of the patients had the first degree AV block in their ECG. However, there were no specific diagnostic tools that could be exactly diagnosed myocarditis, with the additional laboratory examinations for AST and CK-MB, it would help to confirm the diagnosis. The AST and CK-MB levels were elevated in our myocarditis patients. The outcomes of the patients were satisfying. Most of the patients were improved.

The next study better uses prospective study method to reach the validity of frequency, seeks a complete progress of clinical profile and outcome in patients, starts observing from patients admission to the hospital to the patients discharge, with complete non invasive imaging examination, which are ECG, echocardiography, and chest x-ray, and the cardiac enzymes examinations, including AST, Troponin T, CK, and CKMB. In addition, the medical records should be registered appropriately. Physician should be aware of myocarditis especially if facing infection cases.

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